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Reproducing Difference—Race and Heredity from a *longue durée* Perspective

The classification of mankind into three or four major "races"—"white," "black," and "yellow" or "red"—is still very much alive, even in the high-tech contexts of today's genomics and systems biology.[i] For example, the International Haplotype Map Project initially studied human genomic variation based on four "population samples." The choice of these samples is revealing: for its pilot study, the HapMap project looked at "samples from Nigeria (Yoruba), Japan, China and the U.S. (residents with ancestry from Northern and Western Europe [...])."[ii] This choice was no doubt guided by the long-established classification of humans into four big "races" according to skin color, as it was originally proposed by Carl Linnaeus (1707-1778) in his *Systema naturae* of 1735.[iii] The HapMap Project thus exhibits a curious mixture of archaic concepts and the latest tools of molecular biology.

Examples like this indicate a recent resurgence of racial categories in genomics which many observers have found surprising and unsettling.[iv] After all, it was preceded by a broad consensus—both among practitioners and commentators, and dating back to the so-called "UNESCO Statement on Race" from 1951—that the concept of race belongs to the past and has been thoroughly outdated by the combined efforts of mathematical population genetics and molecular biology. However, in the wake of the completion of the Human Genome Project and with projects like the Human Diversity Project, the HapMap Project, various national "biobank" projects, and a diversity of private and public initiatives, racial categories appear to have regained significance in recent years, inside and outside the biomedical sciences.[v] Racial distinctions are used as "proxies" in projects that try to map health disparities onto patterns of genomic variation; drug and life-style recommendations target racially defined groups, and genetic tests purport to determine ancestry in racial terms. Increasingly, close historical scrutiny also reveals that, throughout the post-WWII era, race

was not only occasionally put back on the agenda through high-profile publications such as Richard J. Herrnstein's and Charles Murray's *The Bell Curve* (1994), but actually persisted as a distinct, though little-publicized thread in medical and population genetics research, especially in epidemiological contexts.[vi]

What is it, then, about concepts of race—introduced in a patently *ad hoc* fashion by Linnaeus, and again and again denounced as primitive and untenable by prominent life-scientists in the course of their long history—that lets them persist, despite the rapid, conceptual and technological advances that biology has seen, especially in the twentieth century? In the following, I will try to give an answer to this question based on results from a long-term project on the history of the concept of heredity.[vii] In a nutshell, my answer will amount to the following: the concept of heredity, when it entered biology in the early nineteenth century, did not refer to the fixity of species or the age-old observation that "like engenders like." It was geared rather towards a much more specific phenomenon—namely, that of "heritable variation." From very early on, as I will explain in the first two sections of this paper, hereditary diseases on the one hand, and racial characteristics on the other, formed the paragon of hereditary phenomena. This is of great significance for the history of the human sciences, including anthropology and medicine. First of all, the juxtaposition of pathological and racial characters led to a conflation of the normal and pathological, or the natural and the accidental. Moreover, it was only through the focus on the resulting, somewhat oxymoronic causal constellation—consisting in the production of an original, individual "deviation," whose effects were then "regularly" reproduced in offspring—that a space opened for a truly historical outlook in the life sciences, as epitomized in Charles Darwin's theory of evolution.[viii] Heredity does not follow the logic of natural kinds, but that of historical events with lasting effects. In conclusion, I will come back to my original question, making the point that concepts of human race persist to this day because they have

been indelibly inscribed in the conceptual architecture that has supported, and continuous to support, all attempts at describing and controlling human variation on a global scale since the early modern period.

1. Heredity and disease

"Heredity" originally only had a legal meaning in all European languages and was derived from the Latin "hereditas," meaning inheritance or succession according to rules specified by law.[ix] It was only around 1800 that heredity began to be used as a metaphor to address phenomena of organic reproduction. In the German-speaking world, Immanuel Kant (1724-1804) seems to have been the first to do so in his anthropological writings in the 1770s and 1780s, to which I will return below. The *Oxford English Dictionary* lists Herbert Spencer's *Principles of Biology* from 1863 and Francis Galton's *Hereditary Genius* from 1869 as the earliest references for "heredity" in the modern, biological sense. Carlos López Beltrán has studied in detail, how French physicians—psychiatrists or so-called "alienists" in particular—by the late eighteenth century started to discuss heredity and later dissminated the "philosophical and physiological" use of the term throughout Europe. López Beltrán also points to a peculiar linguistic shift that accompanied the spread of this parlance—namely, a shift from an adjectival (*héréditaire*) to a nominal use (*hérédité*), indicating the reification of the concept, or in López Beltrán's words, the establishment of a "structured set of meanings that outlined and unified an emerging biological conceptual space."[x]

That physicians played a crucial role in the initial shaping of the discourse of heredity is no coincidence. In fact, the dating of the emergence of this discourse around 1800 must admit one notable, but rather narrowly circumscribed exception within medicine. Since the late medieval period, physicians had sporadically referred to diseases that were restricted to particular families as "hereditary diseases." Admittedly, as Maaike van der Lugt has

emphasized, such diseases played a very minor role in scholastic medicine. The dominating doctrine of disease was that of humoral pathology, which defined diseases as disturbances in the balance of the four body humors: blood, phlegm, yellow bile, and black bile.[xi] The constitution of a particular person was believed to result from the specific proportion of these four humors and according to the preponderance of this or that humor distinguished between sanguine, phlegmatic, choleric or melancholic temperaments. What we would call "environmental factors" today, by contrast, were summarized as the six "non-naturals": light and air, nutrition, movement, sleep, excretions, and emotions. These were considered non-natural since they could be influenced by the physician or patient, for example, by keeping to a certain diet, or through blood-letting. In general, therefore, diseases were identified with the states of individual bodies that were elicited by a variety of incidentally or periodically recurring factors, rather than as entities that could be abstracted from their manifestations in individual bodies.[xii]

Thus, within the humoral framework there was little room for a conception of diseases, let alone bodily properties in general, that in any literal sense could be seen as being passed down or transmitted from parent to offspring. When metaphors of inheritance were used in the late medieval and early modern period with reference to diseases that were observed in certain families only, it was therefore not so much the inheritance of mobile and alienable properties—money for example—that people had in mind, but rather the passing on of landed property. Thus Jean Fernel (1497?–1558) maintained in his *Medicina* (1554) that a son is "as well inheritor of his [father's] infirmities as of his lands."[xiii] The problem was not to explain how properties were transmitted, but rather to explain how the causal agents that once had been involved in the generation of ancestors could remain active in the generation of their remote descendents.[xiv] This is how William Harvey (1578-1657) was to formulate this problem more generally in his *Exercises on the Generation of Animals* of 1651: "The knot

therefore remains untied [. . .], namely: how the semen of . . . the cock forms a pullet from an egg . . ., especially when it is neither present in, nor in contact with, nor added to the egg."[xv]

It is precisely this conundrum—a variation on the problem of action at a distance—which also preoccupied those few physicians who in the late medieval and early modern period specifically devoted themselves to hereditary diseases. The first to do so was Dino del Garbo (c. 1280-1327), who taught medicine according to Avicenna's *Canon medicinae* in nothern Italian universities in the early fourteenth century. Two manuscripts from around 1320 survive which contain disputations that deal with the question "whether a disease which is in the father can become hereditary in the son (utrum aliquis morbus qui esset in patri posset hereditarius in filio)."[xvi] Avicenna had already distinguished hereditary from contagious and regional diseases at the beginning of the *Canon medicinae*, but without any further comment.[xvii] Starting from an analysis of the juridical concept of heredity, Dino proceeded to distinguish between truly hereditary (*morbi ex hereditate*) and connate diseases (*morbi ex generatione*). Connate diseases resulted from events that caused a change in the seed or embryo during conception or pregnancy. Dino argued that hereditary diseases, by contrast, had to be present already in the father to warrant the analogy with the transmission of worldly goods. A similar distinction was made slightly later in medical manuscripts by John of Gaddesden (c. 1280-1361), court physician of Edward II in England.[xviii]

Dino del Garbo's careful distinction remained largely ineffective, however, even if the phrase "hereditary disease" from then on appeared occasionally in European medical literature. Many authors applied the term to diseases which, according to Dino, should have been considered connate, such as leprosy, which many believed to arise from intercourse during menstruation. Humoral pathology continued to dominate medical thinking, and Dino had indeed indicated that hereditary diseases were in need of a different explanatory framework. Referring back to Aristotle's theory of generation, he maintained that hereditary

diseases could only be explained by a permanent change in the "formative power" (*virtus formativa*) of the male seed.[xix]

It took almost three centuries for the next attempt at a systematic account of hereditary diseases to appear on the scene. In 1605, Luis de Mercado (1532-1611)—professor of medicine at Vallodolid and court physician of Philipp II of Spain—published *De morbis hereditariis*.[xx] With Dino del Garbo, Mercado assumed that it was a permanent change in the *vis formativa* of the seed which caused hereditary diseases. Unlike Dino, however, he followed Galen in assuming that both the male and the female produce seed which mix in generating the embryo. Hereditary diseases consisted for him in a changed "character (*character*)" of the body, which he described as "preternatural (*praeter naturam*)," as it differed in some respect from the ordinary. To account for such changes, Mercado supposed an interesting metaphor. Since they had to be due to changes in the "virtue of the seed (*vi seminis*) of the parents, grandparent or great-grandparents," it seemed as if "nature regulated the generation of individuals by some instrument (*instrumento*) in such a way that they produce individuals deformed by a similar defect (*eadem labe foedatos*)."[xxi] The expression "character" is borrowed from the Greek and does indeed refer to instruments used for brandishing domestic animals (and slaves!) or stamping money. Alongside this, Mercado also frequently used the term *sigillatio*, derived from *sigillum*, Latin for seal, which in theology denoted the indelible, but invisible nature of the sacraments.[xxii]

This model of inheritance allowed Mercado to distinguish hereditary diseases sharply from connate ones, and it should be integrated with solidist conceptions of disease in the late eighteenth century, which explained disease by a permanent lesion in the structure of the body.[xxiii] Yet even if Mercado thus sometimes spoke of hereditary diseases as "untreatable," he saw some room for therapy. On the one hand, symptoms could be suppressed by adequate diet or treatment, and over the course of several generations such a treatment would also

change the hereditary character. On the other hand, it was possible to compensate for a diseased character by combining it with a healthy one in generation. In this way, Mercado also explained the curious fact that hereditary diseases sometimes jumped one or several generations. Hereditary diseases could remain latent.[xxiv]

Dino del Garbo's and Louis Mercado's discussions of hereditary diseases demonstrate that heredity first emerged as a subject at the periphery of medical discourse. Today it seems evident that every disease has a genetic component. For physicians and natural philosophers in the late medieval and early modern period, however, hereditary diseases were one special form of disease alongside others. The hereditary transmission of diseases appeared as a curiosity. Thus, Michel Montaigne (1533-1592) asked himself when he began to suffer from gall stones at 45 years of age, just like his father had at the same age, what kind of "prodigy (*monstre*)" was hidden in the male seed so that it not only transmitted "impressions" of the bodily conformation, but also of the "thoughts and inclinations of our fathers."[xxv] After all, Montaigne also shared with his father a pronounced antipathy towards physicians. For Montaigne, heredity was not a generalizable, natural phenomenon but an example of the "miracles in obscurity" with which nature confronts humans on a daily basis. What was so intriguing about the gallstones was that they appeared at the same age in both father and son even though the elder had not yet developed this ailment when he generated his offspring. All other examples that Montaigne listed to illustrate heredity share the eccentric character of curiosities. Members of the Roman family Lepidus were often born with one eye covered by cartilage; according to ancient tradition, a Thebian tribe was distinguished by a lance-like birthmark; and, if one believes Aristotle, some of the Greek tribes practicing "women . . . in common" determined paternity by means of such bodily oddities.[xxvi]

Heredity was thus not seen as instantiating a natural law, but quite on the contrary, it belonged to the realm of individual peculiarities and accidental aberrations. "All things are

governed by law" is the conventional translation for the opening sentence of the Hippocratic tract *De genitura* ("On Seed").[xxvii] Yet, it is worthwhile to consult its Renaissance Latin translation: "Law strengthens everything (*Lex quidem omnia corroborat*)," where "law (*νόμος*)," as the translator Girolamo Mercuriale (1530-1606) carefully noted in a comment, means "customs, pasture, region, tribe (*instituta, pascua, regionem, classem*)."[xxviii] Law, in *De genitura*, did not refer to universal laws of nature, but to the persistence of local tradition and circumstance. The foundation for similarities between parents and offspring was thus provided by the fact that, as a rule, similar conditions prevail during procreation and development. Conversely, this meant that any deviation from the ordinary course of things would produce deviant results. The reproduction of similarity was thus as trivial as it was precarious, always remaining vulnerable to disturbances and transgressions.

2. Heredity and human variety

That inheritance was largely seen as something restricted to special circumstances in the early modern period can be seen from the fact that Carl Linnaeus (1707-1778), who was one of the first to propose a universal classification of mankind according to skin color, still felt compelled to underline that skin color should be seen on par with other variable characteristics, like stature or body weight, that clearly depended environmental factors such as nutrition.[xxix] It was only in the course of the eighteenth century, and especially towards its end, that the peculiar behavior of heritable characteristics—the fact that they were transmitted without being influenced by external conditions—began to be seen as an instantiation of something akin to natural laws. Kant played an important role in advancing this perspective, and it is to his writings on race that I now want to turn.

For Kant, no variation in bodily characteristic was not enough to constitute a racial difference. To the contrary, the differentiation of humanity into a set of interrelated races

constituted for him a narrowly circumscribed, highly specific phenomenon. He clearly distinguished racial characteristics from species-specific traits on the one hand, which did not differ at all throughout a species and thus seemed to obey some constant law, and variable traits on the other hand, which either differed in accordance with changing environmental conditions or did not obey any obvious rule at all in their appearance among offspring. Only racial traits, according to Kant's definition, were traits that were invariably transmitted to offspring even under changed environmental conditions, and yet would regularly and predictably blend in hybrid offspring. European parents, to use Kant's favorite example, would continue to produce white children even when living in Africa, and Africans would continue to produce black children even when living in Europe, while both together produced children of an intermediate, brown skin color, again, regardless of the particular environment in which they were born.[xxx] Such a phenomenon, as Robert Bernasconi emphasizes in his contribution to this volume as well, undercut the distinction of specific forms and accidental peculiarities. In characterizing classes at a sub-specific level, racial characteristics belonged to the individual peculiarities that interfered with the universality of species. Yet, these peculiarities were being reproduced infallibly, generation by generation, and thus seemed to be subject to the same kind of laws that governed the reproduction of species.

To account for this, Kant brought together natural law and contingent family history in his concept of *Vererbung*. The dispositions, or *Anlagen*, for hereditary traits were included from the very beginning in the organization of the original stock of ancestors from which all of humanity sprang, and were in this sense preformed and not acquired in a reaction to particular circumstances. Once these dispositions had been expressed as actual traits in reaction to a particular climate, however, they would be permanently and irrevocably transmitted.[xxxi] Again, this behavior might seem to be nothing but a curiosity. But as Raphael Lagier has argued, the explanation of this behavior occupied a central place in Kant's overall

philosophical project. It was able to resolve the major conundrum, clearly realized by Kant, that the supposedly universal moral and epistemological values that underwrote the Enlightenment were of a distinct geographic origin; in short, the Enlightenment was a distinctively "European" achievement, at least in the eyes of Europeans.

Kant explained this conundrum by maintaining that the equipment of the original human stock with *Anlagen* for adaptations to various climates, such as skin color, served the purpose of a universal geographic distribution of humankind. This "natural" distribution was over-run by a further process—the spread of civilization—which Kant saw as uncoupled from the former. The partition of the human species into four races, caused by their adaptation to distinct climates, was for him thus nothing but an accidental feature in relation to the universal spread of civilization—itself a destiny of the human species in as much as it amounted to the full realization of man's rational faculties.[xxxii] Despite being accidental with respect to the destiny of mankind, the partition provided Kant with a rationalization, if not justification, of why certain races would either be overrun by civilization or reduced only to play a certain role in it. Depending on their presumed propensity towards work and reproduction, again a product of climate and soil, Americans were bound to go extinct, Africans to become enslaved, and Asians to be left behind by the process of civilization. Civilization and progress were entirely European affairs; neither essentially, nor necessarily, but by an accident of natural history that happened to place Europe and its (white) inhabitants at the center of the "centrifugal space of human identity," as Lagier puts it.[xxxiii] Racial hierarchies, in other words, were not simply a product of nature, but of the natural history of mankind, involving migrations and adaptations to particular climates.[xxxiv]

What were the sources of Kant's curious concept of race? The concept of human races was not a simple invention of eighteenth century naturalists like Linnaeus, Georges Louis Marie Leclerc, Comte de Buffon (1707-1788), or Johann Friedrich Blumenbach (1752-1840),

who were the authors on whom Kant relied for his account. These naturalists, in their turn, relied on travelers' accounts, which reported a curious system of social stratification, which had been instituted in the Spanish and Portuguese overseas colonies: the so-called *castas*. This classification scheme originated from attempts to find a measure by which legal and social status could be allocated to the various sections of colonial society. It seemed to be primarily based on a classification of people according to skin color and, to a lesser degree, also on hair form and eye color. And children resulting from mixed marriages seemed to be positioned in this scheme by analogy to the simple mechanism of color mixing, implying processes of transmission and "blending" that connected traits of parents with traits of their offspring. During the eighteenth century, the system of *castas* found expression in a rich, pictorial genre in Latin America with pictures devised as sets arranged in serial or tabular form. Each of the individual pictures shows a mixed couple and its child, and each bears an inscription that states the components entering the mixture, that is, each parent's *casta*, and the result of the child's *casta*.[xxxv]

Despite its rigid appearance, the *castas* system remained in constant flux throughout the early modern period, as witnessed by a rich proliferation of *castas* terms. In fact, it was not despite, but just because it was so rigidly based on an abstract classification according to color and on inheritance as an equally abstract mechanism, that the *castas* scheme could cope with this proliferation. The distinction according to colors—white, black, and brown—analytically defined the positions for all sorts of intermediate and more complicated cases. And the transmission and blending mechanism offered a unified explanation for their coming about, in so far as it could be regarded as operating independently of particular circumstances. To determine the *casta* of a person, it therefore sufficed to know the *castas* of his or her parents. Due to its analytic and quasi-mechanical character, the *castas* system could absorb a wealth of new phenomena while remaining stable in its basic outlines. It could therefore also

account for the more capricious phenomena of heredity, like "regressions" or "throw-backs," as exemplified by a special caste in the system, the *torna atras* issuing from a Spaniard and an *albina*, that is, a white, blonde, and blue-eyed woman, which among its great-great-grandmothers had one black woman. Their child was usually depicted with a very dark skin color. The system of *castas*, as Renato Mazzolini put it, constituted "a vast field of 'pre-Mendelian' investigation."[xxxvi]

It was not intended to do so, of course. In its original, local context of colonial America, clothes and occupations played as much an important role in the assignment of *casta* as the possession of particular physical characteristics.[xxxvii] As Renato mazzolini argues in this volume, it was the European commentator who paid particular attention to physical characteristics such as skin color. Once abstract, but purportedly universal classifications had been established on this basis, however, a curious process of accretion set in that brought other properties, including medical, cultural and political ones, back into their fold. This is particularly evident in Linnaeus's successive presentations of human diversity. In the tenth edition of his *Systema naturae*, published in 1758, he did not only note skin color and other physical traits for each of his four races, but also medical temperament (i.e., Americans turn out to be "choleric," Europeans "sanguine," Asians "melancholic," and Africans "phlegmatic"), moral characteristics, preferred clothing, and form of government.[xxxviii]

3. Heredity and the struggle for life

The accretion of facts of widely different kind under the same classification of human races that I described at the end of the previous section is of great significance, as it resulted in a conflation of the normal and pthaological in hereditarian thinking. While a "sanguine" temperament—and hence a disposition towards the development of certain diseases according to medical doctrines of the time—is declared normal for Europeans, it would be abnormal for

them to be phlegmatic, which again is normal for Africans, or so Linnaeus maintains. "Blue eyes (*oculis caeruleis*)," on the other hand, suddenly stick out as a rather odd peculiarity of Europeans in Linnaeus's racial scheme.[xxxix] This tendency towards a conflation of the normal and the pathological became a conspicuous element, often highlighted explicitly, of eighteenth century theories of heredity. Thus Pierre-Louis Moreau de Maupertuis (1698-1759) wrote in his *Venus physique* of 1745 on the occasion of numerous observations of albinos or "white negroes (*Negres-blancs*)": "Whether one takes this whiteness as a disease, or due to some accidental cause, it would always be a hereditary variety, which establishes itself or is effaced in the course of generations."[xl]

Such conflations of the natural and the pathological in late eighteenth-century accounts of human variation infused a lasting element of historicity into subsequent attempts to write the natural history of mankind. In a similar manner as Kant, Maupertuis believed that nature contained the sources of human variations, but that it was "chance or art (*le hazard ou l'art*)" that shaped these into distinct races analogous to breeders who "each year create some new species, and destroy those which are out of fashion."[xli] "If the [white] Negroe, who is presently in Paris," he therefore mused about his chosen subject, "found a *Negresse* here who is as white as he is, he would perhaps have only black children with her, because the number of generations may not have been enough to erase the color of their first ancestors. But if one engaged for several generations in giving white-negroe women to the descendants of this Negroe . . . such alliances would strengthen the race."[xlii] The albino was a rare deviation, something earlier generations of naturalists would have addressed as "preternatural" or "monstruous." Yet suitable measures, according to Maupertuis, could establish albinism as the new norm.[xliii]

This recourse to analogies with breeding technologies, such as selection and inbreeding, to explain patterns of physical distinctness has a long legacy as well, taking us

back once more to the late medieval period, but again in a very narrowly circumscribed context. While Dino del Garbo wrote his disputations on hereditary diseases, European universities also witnessed a revival of ancient conceptions of "noble blood" in the context of polemical disputes about the nature and status of nobility. At the University of Paris, for example, a number of satirical disputations asked jokingly, if nobleman were characterized by long ears, just like certain dog races. This echoed the language of contemporary literature on the breeding of falcons, dogs and horses, which frequently employed notions of "nobility," and also is one of the earliest sources of concepts of race.[xliv] It was again around 1800, that a more somber note was added to this discourse when historians began to connect it with notions of "struggle" and "war." As Michel Foucault emphasized, a number of historians began to describe the English Civil War and the French Revolution as instances of a perennial struggle of distinct human races.[xlv] Thus the French historian Augustin Thierry retraced the origins of the French Revolution to the conquest of Gallic territories and their population by Germanic tribes.[xlvi] In a letter to Friedrich Engels, Karl Marx revealingly called Thierry "*le père* [the father] of class struggle."[xlvii]

This is not the place to retrace these complex developments. I would like, however, to highlight two things: first, quite in line with the original, juridical meaning of heredity, racial characters were seen as the product of a (political) will that contained an element of caprice. The breeder "corrects forms and varies colors, thus producing the Harlequin, the Mopse, etc.," Maupertuis mused, and asked himself, why the "sultans," who keep "women of all known species" in their "serails" do not likewise resolve themselves "to make new species."[xlviii] This implies, secondly, that racial diversity and destiny were not so much understood as the outcome of a necessary, natural law, but rather as the outcome of a historical process involving ever shifting constellations of diverse motivations and forces.

These two motives came to the fore with utmost clarity in Charles Darwin's theory of

evolution. One of the statements most often repeated in his *Origin of Species* (1859) is that there is no "fixed law of development."[xlix] What Darwin aimed at with this statement was to deny that there were laws governing the development of species. There was neither a law guaranteeing the fixity of species, as Carl Linnaeus had believed a century earlier, nor a law constituting progress towards forms of ever higher complexity, as in the theories of species transformation put forward by Jean-Baptiste Lamarck or Darwin's grandfather Erasmus. Yet one of the main principles of Charles Darwin's theory, the "principle of divergence of character," relied on the regular occurrence of heritable variations. So if there was no general law of development, there were at least laws—or "tendencies," as Darwin preferred to call them[l]—that governed the reproduction of individuals. Inheritance, in particular, was defined by Darwin in a crucially peculiar way. Relying on "Dr. Prosper Lucas' treatise, in two large volumes", as well as the experiences of breeders, Darwin defended inheritance against "doubts thrown on this principle by theoretical writers" in the following way:

> When a deviation appears not unfrequently, and we see it in the father and child, we cannot tell whether it may not be due to the same original cause acting on both; but when amongst individuals, apparently exposed to the same conditions, any very rare deviation … appears in the parent … and it reappears in the child, the mere doctrine of chances almost compels us to attribute its reappearance to inheritance.[li]

Inheritance, as is evident from this passage, was for Darwin not a process that simply accounted for similarities between parent and offspring. Such similarities could easily be, and had indeed been for a long time, explained by assuming that similar causes remained active in generation. Much more specifically, inheritance comprised cases in which a *difference* or *deviation* occurred, which was then reproduced despite the fact that both varieties lived under

essentially the same conditions. “The saying that ‘like begets like’,” as Darwin stated in *Variation of Plants and Animals under Domestication* (1868), “has, in fact, arisen from the perfect confidence felt by breeders, that a superior or inferior animal will generally reproduce its kind.”[lii]

It is important to notice that inheritance thus defined, as well as its counterpart, variation, turn out to be capricious, not necessarily adaptive “tendencies.” “Inheritance operates fitfully”, as Robert Bernasconi perceptively observes in this volume, Variation leads to differences reproduced under essentially the same environmental conditions, and by inheritance, identities are retained even if conditions change. In both cases, the results may, but are certainly not necessarily, perfect adaptation. The two sources that Darwin drew upon, Prosper Lucas’ (1805-1885) *Traité philosophique et physiologique de l'hérédité naturelle* (1847), which epitomizes a long medical tradition of dealing with hereditary diseases, and breeders’ knowledge about the production of distinct and constant races, make this point abundantly clear. In both cases, inherited differences are conceived of as individual deviations from a norm, in the former case non-adaptive and in the latter case adaptive, if only measured against the strict selection regime imposed by the breeder. At the very heart of living nature, and not only in its more exceptional productions, such as albinos, Darwin diagnoses capricious forces at work. Hereditary variation is clearly at odds, both with a view that sees organisms as always already adapted to their environments and a view that regards organisms as having limitless plasticity in their interaction with the environment. “Divergence of character,” therefore, brought about by the combined effects of variation, inheritance and natural selection, can, but must not necessarily happen. It depends entirely on the degree to which a new variety is indeed better adapted to the prevailing conditions of life. “We must not … assume that divergence of character is a necessary contingency,” as Darwin put it, “it depends solely on the descendants from a species being thus enabled to seize on many and

different places in the economy of nature."[liii]

With this perspective, nothing can be taken for granted in the long run. It is true that most nineteenth-century theories of heredity were directed towards the economically, socially, and politically disadvantaged, and thus exhibit what Carlos López Beltrán has termed the "hereditary bias" of dominant elites.[liv] This bias should not be mistaken, however, as a sign for steadfast belief in a static, natural hierarchy of "primitive" and "advanced" forms of life. Characteristically, the ancient idea of a scale of beings saw different stages of perfection as necessary ingredients of nature. The modern idea of an evolutionary scale, by contrast, views the less perfect or "primitive" manifestations of nature as something that could, and usually would, eventually be overcome. By the same token, however, success was not guaranteed. Ideologies of progress were therefore invariably coupled with deep-rooted fears of degeneration and calls for technologies of elimination and purification that could counteract the spontaneity of nature.[lv]

4. Conclusion

As is well-known, Darwin's theory of natural selection was met with indifference, if not hostility, in the medical community if we leave aside the important exception of eugenics. Cell biologists like Rudolf Virchow, physiologists like Claude Bernard, bacteriologists like Louis Pasteur, all remained skeptical about it if they commented on evolution at all. This skepticism, however, should be seen as specifically directed against the principle of natural selection. Another centerpiece of Darwin's theorizing, the principle of inheritance—that which starts out as a rare deviation may come to constitute a new norm—did have a huge impact on biomedical thinking. It opened prospects for both the production of specific differences through targeted intervention and the reliable reproduction of such differences in the form of "purified" populations of controlled inheritance. Specific forms ceased to be

eternal and immutable, and entered the realm of what could be created and manipulated. In other words, the recognition of heredity as a central life force opened the road for the entry of targeted, experimental interventions and well-defined model organisms in the life sciences.[lvi]

With respect to humans, experimental intervention and genetic manipulation will always remain problematic, if not anathema. The use of human subjects for experimental purposes is fraught with moral and political problems. I believe this is precisely why we see biologically crude, but historically, socially, and politically, highly significant racial categories constantly re-appear in bio-medical research. Albeit *ad hoc* and "artificial," they provide the conceptual grid of last resort to gauge patterns and capacities for hereditary variation in humans, as the organizers of the HapMap project readily concede.[lvii] In a sense, as physical anthropologists of the nineteenth and twentieth centuries have insisted upon again and again, it is the history of mankind, with its alliances, migrations, revolutions, and conquests which provides the human sciences with its one and only experiment.[lviii] This also means that a dismissal of the concept of human races as "essentialist" or "typological" will usually miss the point.[lix] The science of heredity, and with it the concept of human races, has not left us more subjected to nature. On the contrary, it has turned our very nature into something that is historical through and through, and hence lies open to future projections.

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[i] See Staffan Müller-Wille, "Race and Genomics: Old Wine in New Bottles?" *Journal of the History of Science Technology and Medicine,* n.s., 16 (2008): 363-386.

[ii] See "About the International HapMap Project," http://www.hapmap.org/abouthapmap.html (last accessed 31/08/2012).

[iii] Carl Linnaeus, *Systema naturae* (Leiden: Haak, 1735).

[iv] See for example Deborah A. Bolnick et al., "The science and business of ancestry testing," *Science* 318 (2007): 399–400.

[v] Barbara A. Koenig, Sandra Soo-Jin Lee, and Sarah S. Richardson, eds., *Revisiting Race in a Genomic Age* (New Brunswick: Rutgers University Press, 2008).

[vi] Claudio Pogliano, L'ossessione della razza: Antropologia e genetica nel XX secolo (Pisa: Edizioni della Normale, 2005); Jenny Reardon, Race to the Finish: Identity and Governance in an Age of Genomics (Princeton: Princeton University Press, 2005); Keith Wailoo and Stephen Pemberton, The Troubled Dream of Genetic

Medicine: Ethnicity and Innovation in Tay-Sachs, Cystic Fibrosis, and Sickle Cell Disease (Baltimore: Johns Hopkins University Press, 2006).

[vii] Staffan Müller-Wille and Hans-Jörg Rheinberger, eds., Heredity Produced: At the Crossroads of Biology, Politics, and Culture, 1500-1870 (Cambridge, Mass.: MIT Press, 2007).

[viii] See Staffan Müller-Wille and Hans-Jörg Rheinberger, *A Cultural History of Heredity* (Chicago: University of Chicago Press, 2012), 72-75.

[ix] Franck Roumy, "La naissance de la notion canonique de *consanguinitas* et sa réception dans le droit civil," in *L'hérédité entre Moyen Âge et Époque moderne: Perspectives historiques*, ed. Maike van der Lugt and Charles de Miramon (Firenze: Sismel—Edizione del Galluzzo, 2008), 41-66.

[x] Carlos López Beltrán, "The Medical Origins of Heredity," in *Heredity Produced. At the Crossroad of Biology, Politics and Culture, 1500-1870,* ed. Staffan Müller-Wille and Hans-Jörg Rheinberger (Cambridge, Mass.: MIT Press, 2007), 105-132; see also, Carlos López Beltrán, "In the cradle of heredity: French physicians and *l'hérédité naturelle* in the early nineteenth century," *Journal of the History of Biology* 37 (2004): 39-72.

[xi] Maaike van der Lugt, "Les maladies héréditaires dans la pensée scolastique (XIIe-XVIe siècles)," in *L'hérédité entre Moyen Âge et Époque moderne: Perspectives historiques*, eds. Maaike van der Lugt and Charles de Miramon, (Firenze: Sismel—Edizione del Galluzzo, 2008), 41-66.

[xii] On humoral pathology, see Erich Schöner, *Das Viererschema in der antiken Humoralpathologie* (Wiesbaden: Steiner, 1964).

[xiii] As translated in 1621 by Robert Burton, *The Anatomy of Melancholy* (1652; Project Gutenberg): 61, http://www.gutenberg.org/files/10800/10800-h/ampart1.html. The latin original has *haeredes* (in the plural) for "inheritor" and *possesionum* for "land;" see Jean François Fernel, *Medicina ad Henricum II Galliarum Regem Christianissimum, Vol. 2, Pathologia* (Paris: Andreas Wechel, 1554), 15.

[xiv] Ernma Lesky, "Die Zeugnungs- und Vererbungslehren der Antike und ihr Nachwirken," *Akademie der Wissenschaften und Literatur, Abhandlungen der Geistes- und Sozialwisssenschaftlichen Klasse*, Jahrgang 1950, Nr. 19, (Mainz: Franz Steiner, 1951), 146-155.

[xv] William Harvey, "On Animal Generation," in *The Works of William Harvey*, trans. Robert Willis (London: Sydenham Society, 1847), 169-518, p.354. On the ancient legacy of this problem, see Johannes Fritsche, "The biological precedents for medieval impetus theory and its Aristotelian character," *British Journal for the History*

of Science 44 (2010), 1-27.

[xvi] Quoted from van der Lugt, "Les maladies héréditaires," 277, n. 16.

[xvii] van der Lugt, "Les maladies héréditaires," 281ff.

[xviii] van der Lugt, "Les maladies héréditaires," 288ff.

[xix] van der Lugt, "Les maladies héréditaires," 300.

[xx] The treatise first appeared in Valledolid in 1605 as part of the second volume of Mercado's collected works; see David F. Musto, "The Theory of Hereditary Disease of Luis Mercado, Chief Physician to the Spanish Habsburgs," *Bulletin of the History of Medicine*, 35 (1961): 346-373, p. 346. I have only been able to consult the following, posthumous edition: Luis Mercado, "De morbis haereditariis," in *Lud. Mercati Operum Tomus II* (Frankfurt: Palthenius, 1608), 672-682.

[xxi] Mercado, "De morbis haereditariis,", 672; translation quoted from Musto, "The Theory of Hereditary Disease of Luis Mercado," 361.

[xxii] Mercado, "De morbis haereditariis," *passim*; see van der Lugt, "Les maladies héréditaires," 293, for a discussion.

[xxiii] López Beltrán, "The Medical Origins of Heredity."

[xxiv] Musto, "The Theory of Hereditary Disease of Luis Mercado," 361-362.

[xxv] Michel de Montaigne, *Essais: Texte original de 1580 avec les variantes des éditions de 1582 et 1587*, eds. R. Dezeimeris and H. Barckhausen, 3 vols. (Bordeaux: Féret, 1873), 2, 332; translation quoted from Michel de Montaigne, *The Complete Essays of Montaigne*, trans. Donald M. Frame (Stanford: Stanford University Press, 1976), 578.

[xxvi] Montaigne, *The Complete Essays*,, 578.

[xxvii] Hippocrates, *Hippocratic Writings*, ed. G.E.R. Lloyd (Harmondsworth: Penguin Books, 1950), 317; see Hans Stubbe, *History of Genetics: From Prehistoric Times to the Rediscovery of Mendel's Laws* (Cambridge, MA: MIT Press, 1972), 18-21, for a discussion of this important Hippocratic tract.

[xxviii] Hippocrates, "De genitura," in *Hippocratis Coi Opera qvae Graece et latine extant*, ed. and trans. G. Mercuriale (Venice: Industria ac sumptibus Iuntarum, 1588), 1: 10-16, p. 10 and 15.

[xxix] Carl Linnaeus, *Critica botanica* (Leiden: Wishoff 1737), 152-155.

[xxx] Immanuel Kant, "Bestimnmung des Begriffs einer Menschenrace (1785)," in *Kant's gesammelte Schriften*,

Abt. I.: Kant's Werke, Bd. VIII: Abhandlungen nach 1781 (Akademieausgabe), eds. Königlich Preußische Akademie der Wissenschaften (Berlin: Reimer 1912), 89-106, pp. 91-92; see Peter McLaughlin, "Kant on Heredity and Adaptation," in *Heredity Produced: At the Crossroads of Biology, Politics and Culture, 1500-1870*, ed. Staffan Müller-Wille and Hans-Jörg Rheinberger (Cambridge, MA: MIT Press, 2007), 277-291, for a discussion.

[xxxi] Kant, "Menschenrace," 99-100; see the essay by Roberto Bernasconi in this volume for a detailed discussion of Kant's theory of germs; for a classic account, see Timothy Lenoir, "Kant, Blumenbach, and Vital Materialism in German Biology," *Isis* 71 (1980): 77-108.

[xxxii] Raphaël Lagier, *Les races humaines selon Kant* (Paris: Presses Universitaires de France, 2004): 186; see also Susan M. Shell, "Kant's Concept of a Human Race," in *The German Invention of Race*, eds. Sara Eigen and Mark J. Larrimore (New York: State University of New York Press, 2006), 55-72, and Robert Bernasconi, *Nature, Culture, Race* (Huddinge: Södertörn University, 2010).

[xxxiii] Lagier, *Les races humaines*, 193.

[xxxiv] On Kant's concept of a history of nature, and its ambiguous legaxcy, see Phillip R. Sloan, "Kant on the History of Nature: The Ambiguous Heritage of the Critical Philosophy for Natural History," *Studies in History and Philosophy of Biological and Biomedical Sciences* 37 (2006): 627-648.

[xxxv] Ilona Katzew, *Casta Painting* (New Haven: Yale University Press, 2004).

[xxxvi] Renato Mazzolini, "Las Castas: Inter-Racial Crossing and Social Structure (1771-1835)," in *Heredity Produced: At the Crossroads of Biology, Politics and Culture, 1500-1870*, ed. Staffan Müller-Wille and Hans-Jörg Rheinberger (Cambridge, MA: MIT Press, 2007), 349-373, p. 365.

[xxxvii] On this point, see chapter 5 in, Ruth Hill, *Hierarchy, Commerce, and Fraud in Bourbon Spanish America. A Postal Inspector's Exposé* (Nashville: Vanderbilt University Press, 2005).

[xxxviii] Carl Linnaeus, *Systema naturae*, 10th ed., 3 vols. (Stockholm: Salvius 1758), 2, 20-21. Linnaeus' sources for these associations are unclear as he does not cite any. Traditionally, northern people were considered phlegmatic by humoral doctrine; see, Mary Floyd-Wilson, *English Ethnicity and Race in Early Modern Drama* (Cambridge: Cambridge University Press, 2003), 86. It is also interesting to see that Latin American physicians already began in the late sixteenth century to associate race with medical temperament, disagreeing widely about particulars; see, Carlos López Beltrán, "Hippocratic Bodies: Temperament and *Castas* in Spanish America

(1570-1820)," *Journal of Spanish Cultural Studies* 8, no. 2 (2007): 253-289.

[xxxix] Linnaeus, *Systema naturae*, 2, 21.

[xl] Pierre-Louis Moreau de Maupertuis, *Venus physique* (n.p.: n.n., 1745), 161. My translation. The original reads: "Car qu'on prenne cette blancheur pour une maladie, ou pour tel accident qu'on voudra, ce ne sera jamais qu'une variété héréditaire, qui se confirme ou s'efface par une suite de générations."

[xli] de Maupertuis, *Venus physique*, 140-141.

[xlii] de Maupertuis, *Venus physique*, 139-140.

[xliii] On literary tropes of beauty and breeding in late seventeenth and eighteenth-century Europe see Sara Figal's contribution to this volume.

[xliv] Maaike van der Lugt and Charles de Miramon, Introduction to *L'hérédité entre Moyen Age et époque moderne*, ed. Maaike van der Lugt and Charles de Miramon (Florence: Sismel—Edizione del Galluzzo, 2008), 3-37, p. 3.

[xlv] Michel Foucault, *Society Must Be Defended: Lectures at the Collège de France, 1975-1976*, trans. David Macey (New York: Picador, 2003), 76-81, 99-110.

[xlvi] Loïc Rignol, "Augustin Thierry et la politique de l'histoire: Genèse et principes d'un système de pensée," *Revue d'histoire du XIXe siècle*, 25 (2002), http://rh19.revues.org/document423.html.

[xlvii] Karl Marx and Friedrich Engels, *Collected Works*, vol. 3.7 (London: Lawrence & Wishart, 1975ff.), 130.

[xlviii] Maupertuis, *Venus physique*, 141.

[xlix] For example, Charles Darwin, *On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life* (London: John Murray, 1859), 314, http://darwin-online.org.uk/contents.html.

[l] Darwin, *Origin*,118.

[li] Darwin, *Origin*, 12.

[lii] Charles Darwin, *The Variation of Animals and Plants under Domestication*, vol. 2 (London: John Murray 1868), 2, http://darwin-online.org.uk/contents.html.

[liii] Darwin, *Origin*, 331.

[liv] Carlos López Beltran, *El sesgo hereditario: Ámbitos históricos del concepto de herencia biológica*, (Mexico City: Universidad Nacional Autónoma de México, 2004).

[lv] Anne Carol, Histoire de l'eugénisme en France: Les médecins et la procréation, XIXe-XXe siècle (Paris: Seuil, 1995).

[lvi] Müller-Wille and Rheinberger, *Cultural History of Heredity*, ch. 6.

[lvii] Richard A. Gibbs et al., "The International HapMap Project," Nature 426 (2003), 789-796, p. 791; for the philosophical implications of this strategy, see Lisa Gannett, "The Normal Genome in Twentieth-century Evolutionary Thought," *Studies in the History and Philosophy of Biology and the Biomedical Sciences* 34 (2003): 134-185.

[lviii] On the history of this conception, see "BioHistories," Special issue, *BioSocieties* 5 (2010).

[lix] Staffan Müller-Wille, "Making sense of essentialism," *Critical Quarterly* 53 (2011): 61-77. Nor does the adoption of population thinking, as Lisa Gannett has warned us, provide a bulwark against racism; see Lisa Gannett, "Racism and Human Genome Diversity Research: The Ethical Limits of 'Population Thinking,'" *Philosophy of Science* 68 (2001): S479-S492.